

**DEVICE FOR DECORATION OF CERAMIC TILES****OBJECT OF THE INVENTION**

5 The invention refers to a device and process for decorating ceramic tiles that is based on the projection of ink on the surface to be printed, and whose purpose is to provide a higher printing speed.

10 Another object of the invention consists of providing the head with total modularity, so that the head is comprised of at least two independent printing modules that are easily replaceable, in such a way that in the event that a failure is produced it suffices to remove the defective printing module and to introduce a new one.

15 Just as it is expressed in the title of this specification, the invention is applicable to the decoration of ceramic tiles, but it can likewise be used in any sector of the industry that requires the printing of ink on a surface.

**BACKGROUND OF THE INVENTION**

20 The use of devices that permit the printing of ink on a surface that is conveyed by a conveyor belt or that is immobile, for which purpose it has a control circuit that controls the operation of a head that carries out the projection of drops of ink for the printing of the desired decorative motif, is conventionally widely known.

25 This type of device has the inconvenience that the head is constituted by a single printing element, in such a way that it does not occupy the entire width of the tile, for which purpose in order to print the complete decorative motif it is necessary to make several passings of the surface or of the head in order to complete the decorative motif, which determines that the printing speed is considerably reduced.

35 The use of several heads for printing different colors of ink which likewise has the inconvenience that a single head is used for each color of ink is also known

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in the prior art. The use of a single head for each color of ink likewise determines the need to make several passings in order to complete the desired motif, which also affects the marking speed which is considerably reduced.

It should also be pointed out that conventional heads have the inconvenience that they are not modular and therefore in the event that there is a failure, there is the inconvenience that the repair requires more time.

#### DESCRIPTION OF THE INVENTION

In order to solve the above mentioned inconveniences, the invention has developed a new device for the decoration of a surface by means of printing ink, for which purpose it has means for projecting the ink on the tile in order to print the desired motif; and it is characterized in that it has at least one head that is constituted by at least two independent printing modules, that are connected to a control unit that controls the operation of each printing module independently, in order to print the desired motif.

The independent printing modules are situated in the head obliquely with respect to the trajectory of the tiles, and each head has to include a sufficient number of printing modules that make it possible to cover at least the entire width of the tile, in such a way that with a single passing of the tile along the conveyor belt, the complete printing of the desired motif is carried out, in such a way that the printing speed is increased.

Wider printing modules could also be used, in such a way that they can be placed perpendicular to the printing axis.

The distribution of the printing modules is done in such a way that they are one after another and/or parallel with a certain unalignment, in such a way that the

printing band of each one of said printing modules is situated contiguously to the bands of other printing modules, covering the entire width of the tile.

Each independent printing module is constituted by a microprocessor and the corresponding memory in order to operate independently under the control of the control unit.

Although it has been indicated that at least two printing modules are used, it is evident that a single printing module may be used, as long as this module has dimensions that cover the entire width of the tile.

The device of the invention also considers the possibility of having at least as many parallel heads as printing colors are required to print the desired motif, so that each printing module of each head or heads provided in series, in order to cover the entire width of the tiles is (are) connected with the same ink tank, in such a way that the multicolor printing is done in a single passing, whereby the printing speed is considerably increased.

The described structure of the device of the invention permits a superior printing quality to be obtained than 200 dpi (dots per inch).

The control unit of the device of the invention has communication means in order to carry out its connection to other control computers of other devices, or to other computers by network, memory cards and other communication and data storage systems, in such a way that remote management and verification of the printing devices can be carried out.

Obviously the device of the invention can operate in combination with other conventional decoration devices, such as flat serigraphy, or rotary serigraphy, devices, decoration with a roller or others existing on the market.

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The device of the invention can be applied on those pavings and coverings that are produced by single baking or by double baking, including rapid double baking and porous single baking, and likewise stoneware products and porcelain stoneware products manufactured by single baking. Likewise, the device of the invention is applicable to all those pavings and coverings that are produced by pressing or by extrusion.

It also proves to be evident that the device of the invention can be applied before a first baking or else between successive bakings.

In order to provide a better understanding of this specification and forming an integral part thereof, a series of figures in which the object of the invention has been represented in an illustrative and non-restrictive manner are attached hereto.

#### **BRIEF DESCRIPTION OF THE FIGURES**

Figure 1 shows a schematic plan view of a possible embodiment of the invention in which four parallel heads are used, each one of the heads being connected to a tank with different colors of ink in order to do the marking in different colors.

Figure 2 shows a bottom view of a possible embodiment of the distribution of two different printing modules in one head.

Figure 3 shows a perspective view of a printing module of those included in figure 2.

Figure 4 shows a perspective view of a possible embodiment of the complete device of the invention.

Figure 5 shows a functional block diagram of a possible embodiment of the control circuits of the device of the invention, that permits independent control of each one of the printing modules.

#### **DESCRIPTION OF THE PREFERRED EMBODIMENT**

A description is made hereinafter of the invention

based on the above cited figures.

The device of the invention has a conveyor belt (1) that produces the conveyance of the tiles (2) to be printed and in whose trajectory some heads (3) are arranged so that as the tiles pass along the bottom part of the heads the printing of the desired decorative motif on the tiles (2) is produced.

Each one of the heads (3) is connected to an ink tank (4), each one with a different color, in such a way that each one of the heads does the printing corresponding to the color that the tank with which it is connected includes, the printing of the desired decorative motif ending when the tile passes under the last head (3).

Each one of the heads (3) is constituted by a plurality of printing modules (5), provided with the corresponding slot (6) for the discharge of the projected ink. Therefore, each one of the printing modules (5) of a head (3) projects the same color of ink.

A very important characteristic of the device of the invention, consists of that each one of the printing modules (5) is independent and the control thereof, is likewise done independently, just as it will be explained hereinafter.

The printing modules (5) are located obliquely with respect to the head and to the trajectory of the tiles, and are situated in such a way that they cover the entire width of the tiles, in order to achieve with a single passing of the tile the total printing of the decorative motif. Hence, the printing band of each module (5) is located contiguously in order to cover the entire width of the tile.

A single head has been used in the embodiment for the printing of each color, but obviously more heads can be arranged in series, if it were necessary to cover the entire width of the tile.

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Each printing module (5) includes a control circuit (9), a microprocessor (10) and a memory (11) in order to permit the independent operation of the mechanism (12) for injection of the ink that comes out through the slot (6).

In order to achieve the independent operation of each one of the printing modules (5), a control unit (13) that controls the independent operation of each one of said printing units (5) has been provided for, for which purpose said control unit (13) has a control circuit (14) that is connected to a microprocessor (16), to a screen (19), to a keyboard (18) and to an outside communications module (15) through which the connection to other computers (17) is made possible.

The microprocessor (16) includes the corresponding memory in which the operating program according to the desired decorative motif is included.

Hence, as of the program stored in the microprocessor (16) different instructions are sent to each one of the microprocessors (10) of the printing modules (5) by means of the memories (11), in such a way that each printing module (5) is totally independent and therefore easily replaceable, for which purpose the corresponding connectors that allow the easy removal thereof and the subsequent introduction of a new module are included, thus considerably facilitating the repair in the event of failure.

Therefore, based on the description made, it is easily understood that the decorative motif of the tile is a function of the included program, which in turn should be modified by each one of the microprocessors (10), upon partially reading the information contained in the memory (11), printing different decorative motifs, such as the case of the decoration of marble in which different effects are desired may be, that evidently are not homoge-

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neous for each one of the tiles.

Just as it has been previously expressed, the control unit (13) permits the connection with other computers (17) in order to allow the exchange of information with other devices and/or to permit the remote management and verification of the printing devices.

Reference numeral (7) of figure 4, shows a bridge in which the different heads (3) are included, and the front of the machine includes the keyboard (18) by means of which programming of the device is done and the corresponding screen (19) through which the different data that permit the correct operation of the machine are displayed.

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